

Turbine Performance Score Sheet

(40 points)

Team Name: _____

School Name: _____

Division: 4th-8th or 9th-12th

Energy Output—60 Second Trials (35 points)

Scoring will be based on the best run (no penalty for a bad run). Runs are measured in Joules. **Circle Top Run.**

_____ (J) 1st Run _____ (J) 2nd Run _____ (J) 3rd Run _____ (J) 4th Run
 _____ (J) 5th Run _____ (J) 6th Run _____ (J) 7th Run _____ (J) 8th Run

Catastrophic Failure (Does Not Impact Scoring)

Did not occur High Priority Low Priority

Efficiency (5 points)

Wind Speed (m/s): _____

Horizontal axis: Rotor radius (cm): _____

Vertical axis: Dimension 1 (cm): _____ Dimension 2 (cm): _____

Note: Most turbines are horizontal axis. Only fill in the axis measurements for the correct type of turbine design.

Additional Details About Efficiency Calculation

Efficiency of Wind Turbine (%) = actual power generated ÷ available power × 100

Actual Power Generated = energy production (Joules) of the turbine's best run ÷ 60 seconds

Explanation: Joules = Watts × Seconds; therefore Power (Watts) = energy production (Joules) ÷ time of run (60 seconds)

Available power (P) = $0.59 * \frac{1}{2} * \rho * A * V^3$

- P = power in the wind (watts)
- 0.59 = 59% = Betz limit (theoretical maximum efficiency of wind turbine)
- ρ = density of air (assumed to be 1 kg/m³)
- A = swept area of turbine (square meters)
 - Horizontal axis turbine = $\pi \times \text{radius}^2$ (where $\pi = 3.14$)
 - Vertical axis turbine = $1/2 \times \text{Dimension 1} \times \text{Dimension 2}$
- V = wind velocity (meters/second)

